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The "Appendix" bears the title, "An Appendix to the Logarithmes, showing the practise of the Calculation of Triangles, and also a new and ready way for the exact finding out of such lines and Logarithmes as are not precisely to be found in the Canons." It is an able tract. A natural guess is that the editor of the book, Samuel Wright, a son of Edward Wright, composed this "Appendix." More probable is the conjecture which (Dr. J. W. L. Glaisher informs me) was made by Augustus De Morgan, attributing the authorship to Oughtred. Two reasons in support of this are advanced by Dr. Glaisher, the use of  $\times$  in the "Appendix" as the sign of multiplication (to Oughtred is generally attributed the introduction of the cross  $\times$  for multiplication in 1631), and the then unusual designation "cathetus" for the vertical leg of a right triangle, a term appearing in Oughtred's books. We are able to advance a third argument, namely the occurrence in the "Appendix" of (S\*) as the notation for sine complement (cosine), while Seth Ward, an early pupil of Oughtred, in his *Idea trigonometriae demonstratae*, Oxford, 1654, used a similar notation (S'). It has been stated elsewhere that Oughtred claimed Seth Ward's exposition of trigonometry as virtually his own. Attention should be called also to the fact that, in his *Trigonometria*, page 2, Oughtred uses (') to designate 180°-angle.

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## BERGSON'S THEORY OF INTUITION.

Probably the best example of Bergson's application of the intuitive method is to be found in his account of the ideal genesis of the intelligence in the third chapter of *Creative Evolution*. This gives us the gist of his whole philosophy, and serves to illustrate the difficulties of Bergson's view not only of the nature of intellect, but also of intuition itself. What Bergson proposes to do is "to engender intelligence, by setting out from the consciousness which envelopes it"; that is to say, he proposes that we should actually experience in our own selves the process by which duration, which is pure heterogeneity and pure activity, is degraded into the spatializing intellect and spatialized matter. The intellect left to itself, Bergson argues, naturally tends to the homogeneous and the extended and the static. That is to say, the impression we get of the intellect is as of something unmaking itself. "Extension appears only as a tension which is interrupted." But this suggests to us a

reality of which the intellect is merely the degradation and suppression. "The vision we have of the material world is that of a weight which falls; no image drawn from matter, properly so called, will ever give us the idea of the weight rising." But in the case of life we see "an effort to mount the incline that matter descends." Living things "reveal to us the possibility, the necessity even, of a process the inverse of materiality, creative of matter by its interruption alone" (p. 259), a reality which is purely active, a cosmic impulse which makes itself incessantly.

Now if by means of a powerful effort of the mind we succeed in attaining to this reality, if, as Bergson expresses it, "we put back our being into our will, and our will itself into the impulsion it prolongs, we understand, we feel, that reality is a perpetual growth, a creation pursued without end" (p. 252). But if then we relax the tension which this effort demands, we shall ourselves see, or rather *be*, the reverse movement by which the cosmic impetus is degraded, by a kind of process of solidification or chilling or crystallization, into matter and intellect. Reality is pure creative activity, but apparently this creative activity is interrupted or diverted, and in this interruption of the creative current the material world and the spatializing intellect arise. But the creative current is not degraded utterly nor all at once. It still retains even in its degradation some of the force of the main cosmic stream from which it has been diverted. And so the material world and the materialized and materializing intellect, short apparently of pure mathematics and the mathematical intellect, always exhibit two contrary movements. Matter tends naturally toward homogeneous space and necessary determination, just as the intellect left to itself tends toward geometry. But nevertheless this movement is always counteracted by some form of life the function of which is always to convert determination into indetermination and liberty.

By means of this theory, Bergson thinks, it is possible to avoid the difficulty which confronts the Kantian philosophy as to how it has come about that the categories are adapted to work upon the manifold of sensibility at all. Kant had supposed "that there are three alternatives, and three only, among which to choose a theory of knowledge: either the mind is determined by things, or things are determined by the mind, or between mind and things we must suppose a mysterious agreement. But the truth is that there is a fourth alternative which consists first of all in regarding the intellect as a special function of the mind, essentially turned toward

inert matter; then in saying that neither does matter determine the form of the intellect, nor does the intellect impose its form on matter, nor have matter and intellect been regulated in regard to one another by we know not what pre-established harmony, but that intellect and matter have progressively adapted themselves one to the other in order to attain at last a common form. *This adaptation has, moreover, been brought about quite naturally, because it is the same inversion of the same movement which creates at once the intellectuality of mind and the materiality of things*" (p. 217).

This theory seems to raise far more difficulties than it solves. In the first place it is difficult to understand how the cosmic impulse ever can become degraded at all. Is it because the cosmic impulse, which is God, unceasing life, action and freedom, becomes weary? If so, what becomes of the argument that the cosmic impulse is pure creative activity?—an argument which alone, according to Bergson, can save us from the difficulties and deadlocks of the intellect. The metaphor of the stream of life which becomes diverted by matter only to get a better grip on matter does not help in the least, because this theory was put forward as explaining the genesis of matter. Instead of pure duration explaining matter, matter has to be appealed to in order to explain duration.

Moreover there is a further difficulty in this account of the ideal genesis of matter in connection with Bergson's view of the nature and validity of mathematics. Matter is constituted by the reversal of the cosmic impetus, but this movement of matter toward externality and spatiality is never complete. "Matter is extended without being absolutely extended," because in every actual material system there is always a certain amount of interaction between the parts, whereas in a purely extended system every part would be utterly indifferent to every other part. But although the reversal of the cosmic impetus has originated at once "the intellectuality of mind and the materiality of things," yet the intellect outruns the spatiality of things, and so we get pure mathematics. If this is so then it is untrue to say, as Bergson does, that "intellect and matter have progressively adapted themselves one to another to attain at last a common form" (*Creative Evolution*, p. 217), and we have not bridged over the Kantian antithesis of matter and form.

"Our perception," Bergson says, "whose rôle it is to hold up a light to our actions, works a dividing up of matter that is always too sharply defined, always subordinate to practical needs, consequently always requiring revision. Our science, which aspires to

the mathematical form, over-accentuates the spatiality of matter; its formulas are, in general, too precise, and ever need remaking" (p. 218). "Laws mathematical in form can never be applied completely to matter; for that matter would have to be pure space, and to separate itself from duration." "One cannot insist too much on the artificial element in the mathematical form of a physical law, and consequently in our scientific knowledge of things." "Physics comprehends its rôle when it pushes matter in the direction of spatiality." This becomes still more puzzling when we find that although mathematics pursues this process of further falsifying the false product of the intellect, yet at the finish mathematics gives us "a veritable means of contact" with the Absolute.

The whole argument seems to reduce to this: The practical life, which is, so to speak, a smaller stream diverted from the cosmic impulse in which reality consists, is occupied with the penetration and utilization of material things in order to overcome their determination. In order to help the practical life to realize this object the intellect misrepresents the nature of material things. Mathematics goes one better and carries out completely that process of falsifying reality for the sake of which the intellect was created by life, but in so doing mathematics succeeds in attaining to that reality of which not only material things, but even life itself, are mere degradations. And, further, this reality has degraded itself into intellect and matter in order to overcome the resistance of those falsities, with which it is the business of the intellect to provide life, in order to help life to overcome these falsities.

This is an argument which simply makes one giddy. And it is an argument which shows quite conclusively that Bergson can get meaning into his intuition only by appealing to intellect. Instead of intuition explaining intellect it is always intellect which is used to explain intuition. In answer to this it does not help at all to say, as Bergson does, that matter is always "ballasted with geometry." Matter is ballasted with geometry because our intellect tends naturally toward mathematics. But if our intellect tends towards mathematics, so much the worse, on Bergson's doctrine, for our intellect. Bergson has really repeated the performance of Kant. He has offered a justification of mathematics which is really the condemnation of mathematics. If the only reality is intuition then mathematics is false. And if, on the other hand, mathematics is true then the intellect and not intuition gives truth.

To sum up. All of Bergson's arguments for the incompetence

of the intellect break down. They either beg the question at once, in that intellect is defined in such a way as to mean something which cannot give truth, or they involve an appeal to the intellect the incompetence of which they are designed to demonstrate. On the other hand, Bergson's intuition, which is to give relief from the deadlocks which the intellect creates, will do nothing of the sort. Not only does it raise more difficulties than it solves, but it can only be expressed by reference to the intellect and the objects of the intellect.

The reason for this collapse of the Bergsonian philosophy is obvious. Bergson has only repeated the mistakes for which he reproaches Kant. In order to save the freedom of the will, God and immortality from all possible assaults of the intellect, Kant put these realities outside all possible knowledge. In much the same way, in order to have an answer to all possible difficulties which the intellect creates (and because he is apparently ignorant of the intellectual solution of certain classic difficulties), and in order to be able to say that what gives truth is not intellect, Bergson has to make intellect and intuition radically opposed to one another. But having so separated intellect and intuition, Bergson cannot justify either of them. He has not dealt fairly with intellect and has restricted it beforehand to that which is assumed not to be real. At the same time every attempt which Bergson makes to apply his doctrine of intuition, to show why intuition is necessary to supplement intellect, contradicts his own account of the nature of intuition.

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#### ANYNESS AND PURE FORM.

On another page in this issue, Prof. E. H. Strange criticizes Bergson's theory of intuition and derives it from Bergson's opposition to Kant's idealism.

In this connection it is appropriate to state that Kant bases his philosophy on the consideration that the highest laws of nature are identical with the mathematical or purely formal theorems. The latter are verified and indeed created by pure reflection, which means they are mind-made; or, as Kant expresses himself, they are products of *a priori* thought, they are transcendental, they serve us as the forms with whose help we reduce sense-impressions to well regulated experiences.